

*HyDraulics*  
3/26/03  
PATENT  
*John E. Tomaschke*

**IN THE UNITED STATES PATENT AND TRADEMARK OFFICE**

In Re Application of ) FOR: LOW PRESSURE REVERSE  
 ) OSMOSIS AND NANOFILTRATION  
 JOHN E. TOMASCHKE ) MEMBRANES AND METHOD FOR  
 ) THE PRODUCTION THEREOF  
 Serial No.: 09/724,883 )  
 Filing Date: November 28, 2000 ) Group Art Unit: 1723

**DECLARATION/AFFIDAVIT OF JOHN E. TOMASCHKE  
UNDER 37 C.F.R. § 1.132**

I, JOHN E. TOMASCHKE, hereby declare and state that:

1. I am the inventor named in the above-identified patent application. I am Director of Membrane Development for Hydranautics, Inc., the Assignee of the present application. I have practiced in the field of reverse osmosis, nanofiltration and membrane technology for a number of years and hold scientific academic degrees consistent with such practice and with the position I now hold.
2. I am familiar with all prior proceedings in this application before the Patent Examiner, including the most recent Office Action dated March 26, 2003.
3. I have read the references cited in that Office Action, namely U.S. Patent No. 4,983,291 to Chau, Light and Chu (assigned to Allied-Signal Inc.) and U.S. Patent No. 6,083,278 to Koo and Yoon (assigned to Saehan Industries Inc.). I am familiar with the two technologies described in these patents and fully understand the disclosures of the references. I have discussed these references and the Office Action with my patent counsel and am advised that the legal basis of the Examiner's rejection of the present claims in the patent application is that, in the Examiner's opinion, if a person skilled in the art combined the teachings of the Chau and Koo patents in the manner identified by the Examiner in the Office Action, that person would consider my claimed invention to be obvious from those combined teachings.
4. In order to support my contention in the accompanying Response to Final Rejection Under 37 C.F.R. § 1.113 that the Examiner's opinion of obviousness is incorrect, I have

conducted technical tests in which I compared examples my invention directly with equivalent examples of their inventions described by Chau and Koo in their patents. In the Table on the next page I have identified my comparative examples as "Comp." A, B, C and D. The Chau and Koo examples are clearly identified. The comparisons are of the respective formulations, processes and performances of the three inventions.

5. In the Table several abbreviations are used. These abbreviations are listed below along with their meanings.

DABCO = 1,4-diazabicyclo(2,2,2)octane

MPD = m-phenylene diamine

TMC = trimesoyl chloride

Isopar® = commercial isoparaffic solvent product from Exxon Corp.

MSA = methanesulfonic acid

PTSA = p-toluene sulfonic acid

ESPA® = commercial composite polyamide RO membrane from Hydranautics Corp., described in detail in U.S. Patent No.5,576,057.

gfd = gallons/ft<sup>2</sup>-day

'883 = membrane made according to the present invention

The tests were all conducted at 75 psig and a solution of 2000 ppm NaCl and are with respect to membranes for use in water softening.

(Table follows on next page;

Text resumes on page 4)

TABLE

| Example      | Membrane Substrate | Reactive Amine Formula | Crosslink Formula | Post Treatment    | Drying | Flux (gfd) | Rejection (%) |
|--------------|--------------------|------------------------|-------------------|-------------------|--------|------------|---------------|
| Koo, Exp. 1  | polysulfone        | MPD, DABCO, MSA        | TMC in ISOPAR®    | 90°C for 3.5 mins |        | 4.3        | 98.0          |
| Comp. A      | same               | MPD, MSA               | same              | same              | 2.4    | 97.7       |               |
| Comp. B      | same               | ESPA®                  | ESPA®             | similar           | 13.0   | 98.2       |               |
| Comp. C      | ESPA®              |                        | DABCO, MSA        | 90°C for 2 mins   | 14.0   | 98.5       |               |
| Chau, Exp. 5 | same*              |                        | PTSA              | 170°C for 2 mins  | 6.6    | 95.2       |               |
| Comp. D      | same*              |                        | PTSA              | 90°C for 2 mins   | 13.8   | 98.2       |               |
| '883         | same*              |                        | MSA               | same              | 28.4   | 87.4       |               |

\* Chau's membrane substrates and those of the present invention's compositions are essentially equivalent to the ESPA® product with respect to properties relevant to comparison as to post treatment technology. Therefore to expedite the collection of these data, Applicant has used the commercial ESPA® product as the functional equivalent for these membrane substrates. Such use does not alter the results of the tests or the validity of the comparisons for patent purposes in any manner.

6. From the data in the Table, the following conclusions can be drawn.
  - a. The Koo formulation system, which does not use any post-treatment step, results in an RO membrane which has a low flux and high salt rejection (Koo, Exp. 1). This type of membrane would be unsuitable for nanofiltration and water softening. Removing the DABCO tertiary amine from Koo's amine salt formulation results in a membrane with even lower flux and continued high rejection (Comp. A).
  - b. Substituting a system equivalent to Hydranautics' commercial ESPA® product but without post treatment improves the flux significantly (Comp. B). Using the commercial ESPA® product as designed with post treatment provides even better flux (Comp. C).
  - c. Chau's system, which has post treatment but with a sulfonic acid outside the carbon range of C<sub>1</sub>-C<sub>6</sub>, has a poor flux rate and high rejection, not much better than those of Koo (Chau, Exp. 5). The flux rates of both Koo's and Chau's inventions are well below the minimum required for water softening applications. Reducing the amount of drying for the Chau system results in a product with somewhat better flux, but the rejection rate is increased back to the level of Koo (Comp. D).
  - d. The present invention, however, as shown in the last line of the Table ('883), which has post treating with a sulfonic acid having a carbon number in the claimed range of C<sub>1</sub>-C<sub>6</sub>, has greatly improved flux (4 times higher than Chau, 7 times higher than Koo, and 2 times higher than Comp. D) along with markedly reduced rejection over all of the other systems.
7. I believe that it would be apparent to one skilled in the art from these data that neither Koo nor Chau would lead one to the present invention. Variations to focus on improvements in Koo or Chau individually (Comps. A, B and D) do not provide more than limited improvement. The commercial ESPA® product of Applicant's assignee can be considered to be an example of a system somewhat like what the Examiner is relying on in his rejection, i.e., using a Koo-like system but with a Chau-like post-treatment (Comp. C), but it will be seen that the results still are well below the properties obtained by the

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product of this invention ('883).

8. I have been advised by patent counsel that comparative testing submitted in patent applications is required to compare the claimed invention directly with the art which is the closest to the basis of the Examiner's rejection. I believe that these data have been obtained in a manner fully in compliance with that requirement. As I have stated above, I am aware that the Examiner has cited Chau and Koo in combination in the Office Action. It is not technically possible to make usable membranes for testing by combining components from Koo into the process of Chau as the Examiner proposes in the Office Action. Therefore the closest that I or any person skilled in the art can come is to test the claimed invention against Chau and Koo separately and to examine products (such as the ESPA® product) which to some extent parallel the speculative system proposed by the Examiner, both of which I have done for this comparison.

9. This ends my statement.

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I further declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further, that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issuing thereon.

Date: 6/18/03 Signed: John E. Tomaschke  
John E. Tomaschke

(Attorney Docket No. 7703-PA02)